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A-scan ultrasound measurement of ocular changes during accommodation

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Abstract

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Committee Chair

Niles Roth

Subject Categories

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A-SCAN ULTRASOUND MEASUREMENT OF OCULAR CHANGES DURING ACCOMMODATION

BY

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Adviser:

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OF OCULAR CHANGES DURING
ACCOMODATION

Place: Pacific University, Forest Grove, Oregon

Niles Roth
Niles Roth, M. Opt., Ph.D

7 April '88
Date

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Description of Project

I worked with Dr. Dennis Smith on this project who used this thesis for his Master of science degree. The complete thesis is found in the library at Pacific University. (ref; Thesis Masters, Smith D L 1987, c. 2) I assisted in equipment set-up and design. I was involved in research, choosing of subjects and conducted the testing of subjects with the ultrasound unit. I sat with Dr. Smith in discussion of the results of the project and was involved in part of the write-up of the thesis.

The purpose of the project was to investigate how the refractive surfaces of the eye change during accommodation. We used an A-scan ultrasound unit by coopervision to measure these changes to obtain results within .1mm which reflects changes as small as .25 Diop. We set out to prove 1 of 2 existing theories about how the eye changes during accommodation. The Helmholtz-Fincham theory states that the lens and anterior chamber change during accommodation while Storey and Coleman feel there are vitreous chamber and axial length changes.

We took measurements of 16 subjects who were healthy with dark irides. Bell retinoscopy was performed on the subjects to obtain accurate distances of accommodation with 1, 2 and 3 diopter responses. Subjects were tested under noncycloplegic and cycloplegic conditions. Subjects were instructed to look at different distances under these conditions. While the

subjects were focusing at different distances ultrasound measurements were taken of the anterior chamber depth, the lense thickness and axial length of 1 eye. These measurements were also taken over time to observe differences under cycloplegic conditions as the ability to accommodate slowly decreased.

We found significant changes in the anterior chamber depth and lens thickness during accommodation. With increased accommodation the lens thickness increased and the anterior chamber depth decreased. There were no significant changes noted in vitreous chamber depth or axial length. We also found the time course of action of two drops of 1% cyclopentolate with full cycloplegia was reached between 35 and 45 minutes for most subjects. Some showed slight accommodative changes even up to 60 minutes into the cycloplegia.

Our findings were consistent with the Helmholtz-Fincham theory of accommodation. We were also able to demonstrate the time course of 1% cyclopentolate by observing structure changes inside the eye directly with ultrasound.

We believe there are several reasons why present technology is unable to confirm or refute theories by Coleman and Story about accommodation. To support their theory we would need to obtain measurements accurate within .01mm. Small movements by subjects and variability of probe pressures could account for errors up to .10mm or more. Until human variables are controlled it would be impossible to make claims of axial resolution beyond the .05mm range.